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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : F02M 27/02, 27/04

A1

(11) International Publication Number: WO 98/02656

(43) International Publication Date: 22 January 1998 (22.01.98)

(21) International Application Number: PCT/GB97/01930

(22) International Filing Date: 14 July 1997 (14.07.97)

(30) Priority Data:
9614705.3 12 July 1996 (12.07.96) GB

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(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published

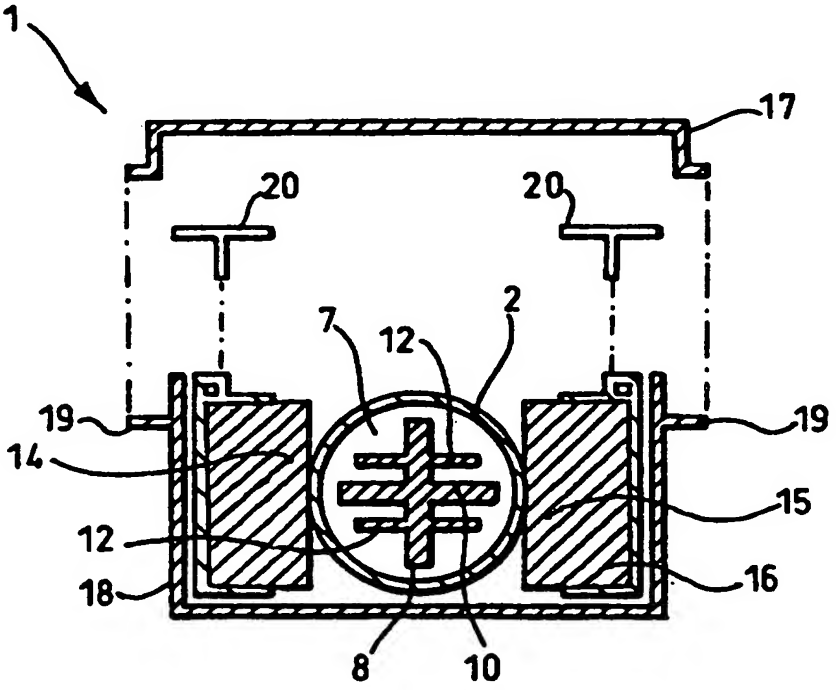
With international search report.

Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: FUEL TREATMENT DEVICE

(57) Abstract

Fuel treatment device for use on a fuel supply line comprises a housing (2) adapted to form part of the fuel supply line and a catalyst (8) located within the housing (2) such that in use the catalyst is located in the fuel flow path (7). One or more magnets (14, 15) are located outside the housing (2) such that at least part of the catalyst (8) lies within the magnetic field of one or more of the magnets (14, 15).



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FUEL TREATMENT DEVICE

The present invention relates to a fuel treatment device and, in particular, to such a device for use in the fuel supply line of fuel burning installations.

It is known that a tin alloy placed in the fuel supply line of an internal combustion engine improves the octane rating of the fuel. It is also known to use the magnetic field of a magnet suitably located in the form of a sealed unit on a gas supply line to improve burning efficiency. However, such units must be placed near the combustion chamber so that the fuel is subjected to the magnetic field shortly before entering the combustion chamber. Furthermore, such units can often only have a limited local effect on the fuel due to their construction. However, since the magnetic field strength at a given point is proportional to the inverse of the square of the distance between the magnet and that point, placing such units end to end does not help due to loss in the strength of the magnetic field as the units are successively located further from the combustion chamber.

US 5,520,158 discloses a magnetic field fuel treatment device comprising a plurality of pairs of magnets aligned along a fuel conduit. Such a device however must be located sufficiently close to the burner to preserve the full enhancement effect of the fuel being subjected to the magnetic field.

EP 0 399 801 describes a fuel treatment unit having tin alloy pellets located in the magnetic field of a pair of magnets. Both the pellets and the magnets are located in the fuel supply line of an internal combustion engine whereby the fuel first passes over the pellets and then

passes between and around the magnets. Such a unit is only suitable for use with internal combustion engines where the fuel is burned within the engine. The unit must be placed near the combustion chamber. Furthermore, such units are only effective for treating petrol and as such cannot be used effectively in industrial applications.

GB 2 247 919 also describes a fuel treatment unit for internal combustion engines. This unit has a tin alloy body and a magnet downstream thereof, both located in the fuel supply line. The unit ensures that the fuel passes through the magnetic field after exposure to the tin alloy. For improved efficiency, the alloy is shielded from the magnetic field. Again, this unit must be located near the combustion chamber to be effective and is only useful for treating petrol/diesel. Furthermore, the housing of the unit which defines the fuel flow path is magnetic and forms part of the magnetic circuit. For this reason, and as with the unit of EP 0 399 801, since the catalyst and magnet(s) are located in use within the fuel supply line the units are not easily serviceable and cannot be serviced without first stopping the fuel flow through the units.

The present invention has been made from a consideration of the limitations of known fuel treatment devices and in order to provide an improved fuel treatment device which meets one or more of the following preferred objects.

One preferred object of the invention is to provide a fuel treatment device which is effective for use with a wide variety of fuel types, particularly industrial light oil, heavy oil or diesel and in a variety of applications, particularly industrial or commercial oil burning

installations or applications such as boiler systems, power plants or the like.

A further preferred object of the invention is to provide a fuel treatment device which is not required to be located near the combustion chamber of an oil burning installation to achieve the desired efficiency. Another preferred object of the invention is to provide a fuel treatment device for use in-line on a fuel supply line and which may be readily serviceable, preferably without shutting down the system to which it is installed.

Another preferred objective is to design a unit that will also be effective on large commercial gas pipework. A cost effective but efficient system can be produced by narrowing the pipe, for example by reducing cylindrical pipes to box sections to maximise the magnetic flux, minimise weight and overcome problems of turbulence.

According to a first aspect of the invention there is provided a fuel treatment device for use on a fuel supply line comprising a housing adapted to form part of the fuel supply line, a catalyst located within said housing such that in use the catalyst is located in the fuel flow path and one or more magnets located outside said housing wherein at least part of the catalyst lies within the magnetic field of one or more of said magnets.

The housing preferably defines part of the fuel flow path. Preferably, the housing comprises an elongate tubing which may be of circular or rectangular cross-section. In some applications the housing may for example comprise a W or repeat W shaped piece of tubing to fit into the required space in a burning installation. Thus,

the housing may be shaped and sized as required to suit a particular application.

Preferably, the catalyst comprises an elongate body which will typically extend longitudinally within the housing. Preferably, the catalyst extends substantially along the length of the housing. Thus, the catalyst may have an overall W, repeated W shape or other suitable shape to correspond to shape of the housing. Preferably, the catalyst comprises an elongate backbone lying substantially along the central region of the housing with one or more side fins extending substantially transversely from the backbone towards the housing. In the preferred embodiment, the catalyst comprises an elongate body having a cross shaped section, the centre of the cross being located substantially centrally of the housing and two side fins extending substantially transversely, one on each side, from each of two opposing legs of the cross shaped section and substantially parallel to the other two opposing legs of the section. Preferably, the outer peripheral edges of the elongate body lie close to or adjacent the internal wall of the housing.

Preferably, the catalyst comprises an alloy, typically a tin alloy. The tin alloy preferably comprises 50-90% by weight of tin. Other components of the alloy may include by weight 6-30% antimony, 1-10% lead and/or 3-20% mercury. Preferably, the alloy comprises substantially 70% tin, 18% antimony, 3% lead and 9% mercury. The catalyst may comprise a plurality of longitudinally aligned bodies to form the elongate body thereof. Preferably, such bodies are aligned end-to-end within the housing.

Preferably, one or more of the magnets comprise an elongate body or a series of longitudinally aligned bodies to form an elongate body, typically placed end-to-end. Preferably, two such elongate bodies are provided, preferably on or along diametrically opposed sides of the housing. Preferably, one or more of the magnets extend substantially along the length of the housing. Thus, the magnets may have an overall longitudinal shape corresponding to that of the housing.

Preferably, such magnets comprise bar magnets. Preferably, such magnets comprise an anisotropic permanent ferrite magnet. Preferably, such magnets comprise blocks in the form of a flat cuboid with the poles on each of its opposite longer flat faces. Preferably, the magnets are arranged with their pole faces substantially parallel to the longitudinal axis or axes of the housing.

Preferably, the magnets are arranged such that the magnetic force across the housing is successively repulsive, attractive and repulsive. Preferably, such successive forces each extend along substantially one third of the length of the housing.

Preferably, the magnets are located within an outer casing, typically a rectangular box having a removable cover. Typically the housing is located centrally within such casing and each end of the housing extends through corresponding end walls of the casing. The magnets may be releasably retained within said casing by suitable magnet holders or trays. Preferably, the magnet holders or trays comprise a magnetic material such as mild steel. Preferably, keys or other suitable locking means are provided for securing the magnet holders or trays within the casing. Lockable tabs or the like may be provided for

securing the cover of the casing. Thus, the casing cover may be removed and the magnet holders or trays released and removed for replacing or servicing the magnets. Such servicing may be undertaken while the device is connected to a fuel supply line. Thus, a considerably advantage of the present invention is the ability to service the magnets without removing the device from the installation and consequently without having to shut down the system to which it is installed. Such servicing of the magnets cannot be undertaken on the prior art devices since the magnets are located within the fuel supply line.

Preferably, the housing comprises an anti-magnetic material such as stainless steel. Preferably, the housing is provided at each end thereof with suitable means for connecting the housing to the fuel supply line. Since the housing defines part of the fuel flow path, it will typically have a through bore through which the fuel flows. Preferably, at least one end of the housing has a releasable fitting which may for example be screwed onto that end of the housing. The releasable fitting allows removal of the catalyst, which is preferably releasably secured to the housing, for servicing or replacement. When the catalyst is in the form of an elongate body such removal is facilitated. It will be appreciated that removal of the catalyst is not feasible with the aforementioned prior art devices.

Preferably, the catalyst and the magnets are arranged relative to the housing such that at least part of the catalyst and at least part of such magnets lie in the same cross-sectional plane of the housing. Thus, preferably, in use, the fuel simultaneously passes at least part of the magnets and the catalyst, the magnets being physically isolated from the fuel flow path by the housing.

Preferably, the relative location of the catalyst and magnets is arranged such that the catalyst lies in the region of greatest magnetic field strength.

According to a second aspect of the invention there is provided a fuel treatment device for use on a fuel supply line comprising a housing adapted to form part of the fuel supply line, an elongate catalyst located within said housing such that in use the catalyst is located in the fuel flow path, said catalyst extending substantially parallel to at least part of said housing, and one or more elongate magnets extending substantially parallel to said catalyst, the catalyst and such magnets being arranged such that at least part of the catalyst and at least part of such magnets lie in the same cross-sectional plane of the housing.

According to a third aspect of the invention there is provided a method of treating fuel comprising simultaneously conveying said fuel past an elongate magnet and an elongate catalyst. Preferably, the magnet is physically isolated from the fuel by suitable means such as a housing, which may define the fuel flow path.

It will be appreciated that any of the aforedescribed features may be combined with any aspect of the invention and any aforementioned aspect of the invention may include features from any other aspect of the invention.

It has been found that the synergistic effect of having the catalyst located in the magnetic field, particularly in the form of the embodiments of the invention described, gave results on testing the efficiency of the device which were significantly better than could have been expected. It has been found that the

use of the catalyst encased in a magnetic field promotes the free radical effect on the surface of the catalyst or tin alloy. The device and method of the invention have been found to be particularly suitable for treating fuel in industrial applications such as in steam raising boilers, furnaces, ovens, indirect fired production processes, power turbine generation inter alia. A particular advantage of the device of the invention in relation to such applications is that the device is effective even when not placed near the combustion or burning unit.

Furthermore, the use of magnets which are not located in the fuel flow path avoids problems which may arise from locating the magnets in the path such as wear, friction, corrosion or obstruction of the fuel flow.

The invention will now be described further by way of example only and with reference to the accompanying drawings in which:

Fig. 1 is a plan view of one embodiment of device with the top cover removed;

Fig. 2 is a side view of the embodiment of Fig.1; and

Fig. 3 is a cross-sectional view of the embodiment of Fig.1.

Referring to the drawings, the fuel treatment device 1 comprises a housing 2 in the form of an inner tubing which may have a circular or rectangular cross-section. The housing 2 is adapted at each end 4, 6 to be connected to a fuel supply line (not shown) so that the housing defines part of the fuel flow path 7. An elongate tin

alloy body 8 is located centrally within the housing 2 and extends longitudinally along substantially the length of the housing. In use, fuel flows through the housing 2, over the alloy 8. As shown in Figure 3, the alloy body 8 comprises a cross member 10 having laterally extending side fins 12 so that the body presents a large surface area to the passing fuel.

Two series of magnets 14, 15 are located along the outer wall of the housing, on diametrically opposed sides thereof. The magnets 14, 15 are physically isolated from the fuel flow by the housing 2. The magnets extend substantially along the length of the housing and the alloy body 8 is within the magnetic field. The thickness of the magnets can be chosen as desired. In use, fuel passes over the alloy 8 and simultaneously through the magnetic field which extends throughout the length of the housing. The magnets have their pole faces substantially parallel to the wall of the housing 2. In the preferred embodiment the regions of the magnets 14, 15 adjacent each end of the housing have a repulsive force between them and the regions of the magnets 14, 15 central of the housing have an attractive force between them. It will be appreciated however that other relative magnet arrangements may be used. In particular, the magnetic arrangments and all other parameters referred to in US 5,520,158 may be used. The magnets are retained on trays 16 which are releasably secured to an outer casing 18 by means of keys 20. Thus, the magnets 14, 15 may be removed for servicing or replacement. The outer casing 18 has a cover 17 which may be removed for access to the magnets 14, 15 and which is retained on the casing body by lockable tabs 19. One end 6 of the housing 2 has an unscrewable fitting 22 to allow removal of the catalyst 8 for service or replacement.

In use, the device is connected to the fuel supply line of a burning installation so that the fuel passes through the housing thereby passing over the catalyst while simultaneously passing though the magnetic field of the magnets. The simultaneous combined effect of the catalyst and magnets provides improved and unexpected efficiency of fuel treatment. The effective length of the device, whether straight or zig-zag shaped, may be selected as desired for the particular application. It will be appreciated that relatively long devices may be effectively used to treat the fuel over a longer section of the fuel flow path.

It will be appreciated that the present invention is not intended to be restricted to the details of the above embodiments which are described by way of example only.

CLAIMS:

1. A fuel treatment device for use on a fuel supply line comprising a housing adapted to form part of the fuel supply line, a catalyst located within said housing such that in use the catalyst is located in the fuel flow path and one or more magnets located outside said housing wherein at least part of the catalyst lies within the magnetic field of one or more of said magnets.

2. A fuel treatment device according to claim 1, wherein the housing defines part of the fuel flow path.

3. A fuel treatment device according to any preceding claim, wherein the housing comprises an elongate tubing.

4. A fuel treatment device according to any preceding claim, wherein the catalyst comprises an elongate body.

5. A fuel treatment device according to any preceding claim, wherein the catalyst extends substantially along the length of the housing.

6. A fuel treatment device according to any preceding claim, wherein the catalyst comprises an elongate backbone lying substantially along the central region of the housing with one or more side fins extending substantially transversely from the backbone towards the housing.

7. A fuel treatment device according to any preceding claim, wherein the catalyst comprises an elongate body having a cross shaped section, the centre of the cross being located substantially centrally of the housing and two side fins extending substantially transversely, one on each side, from each of two opposing legs of the cross

shaped section and substantially parallel to the other two opposing legs of the section.

8. A fuel treatment device according to claim 7, wherein the outer peripheral edges of the elongate body lie close to or adjacent the internal wall of the housing.

9. A fuel treatment device according to any preceding claim, wherein the catalyst comprises an alloy.

10. A fuel treatment device according to claim 9, wherein the alloy comprises 50-90% by weight of tin.

11. A fuel treatment device according to claim 9, wherein the alloy comprises substantially 70% tin, 18% antimony, 3% lead and 9% mercury.

12. A fuel treatment device according to any preceding claim, wherein the catalyst comprises a plurality of longitudinally aligned bodies to form the elongate body thereof.

13. A fuel treatment device according to any preceding claim, wherein one or more of the magnets comprise an elongate body or a series of longitudinally aligned bodies to form an elongate body.

14. A fuel treatment device according to claim 13, wherein two such elongate bodies are provided on or along diametrically opposed sides of the housing.

15. A fuel treatment device according to any preceding claim, wherein one or more of the magnets extend substantially along the length of the housing.

16. A fuel treatment device according to any preceding claim, wherein such magnets comprise bar magnets.

17. A fuel treatment device according to any preceding claim, wherein such magnets comprise an anisotropic permanent ferrite magnet.

18. A fuel treatment device according to any preceding claim, wherein such magnets comprise blocks in the form of a flat cuboid with the poles on each of its opposite longer flat faces.

19. A fuel treatment device according to any preceding claim, wherein the magnets are arranged with their pole faces substantially parallel to the longitudinal axis or axes of the housing.

20. A fuel treatment device according to any preceding claim, wherein the magnets are arranged such that the magnetic force across the housing is successively repulsive, attractive and repulsive.

21. A fuel treatment device according to claim 20, wherein such successive forces each extend along substantially one third of the length of the housing.

22. A fuel treatment device according to any preceding claim, wherein the magnets are located within an outer casing.

23. A fuel treatment device according to claim 22, wherein the housing is located centrally within such casing and each end of the housing extends through corresponding end walls of the casing.

24. A fuel treatment device according to any preceding claim, wherein the magnets are releasably retained within said casing by suitable magnet holders or trays.

25. A fuel treatment device according to claim 24, wherein the magnet holders or trays comprise a magnetic material such as mild steel.

26. A fuel treatment device according to any preceding claim, wherein at least one end of the housing has a releasable fitting.

27. A fuel treatment device according to any preceding claim, wherein the catalyst and the magnets are arranged relative to the housing such that at least part of the catalyst and at least part of such magnets lie in the same cross-sectional plane of the housing.

28. A fuel treatment device according to any preceding claim, wherein, in use, the fuel simultaneously passes at least part of the magnets and the catalyst, the magnets being physically isolated from the fuel flow path by the housing.

29. A fuel treatment device according to any preceding claim, wherein the relative location of the catalyst and magnets is arranged such that the catalyst lies in the region of greatest magnetic field strength.

30. A fuel treatment device for use on a fuel supply line comprising a housing adapted to form part of the fuel supply line, an elongate catalyst located within said housing such that in use the catalyst is located in the fuel flow path, said catalyst extending substantially parallel to at least part of said housing, and one or more

elongate magnets extending substantially parallel to said catalyst, the catalyst and such magnets being arranged such that at least part of the catalyst and at least part of such magnets lie in the same cross-sectional plane of the housing.

31. A method of treating fuel comprising simultaneously conveying said fuel past an elongate magnet and an elongate catalyst.

32. A method of treating fuel according to claim 31, wherein the magnet is physically isolated from the fuel.

33. A fuel treatment device substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

34. A method of treating fuel substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

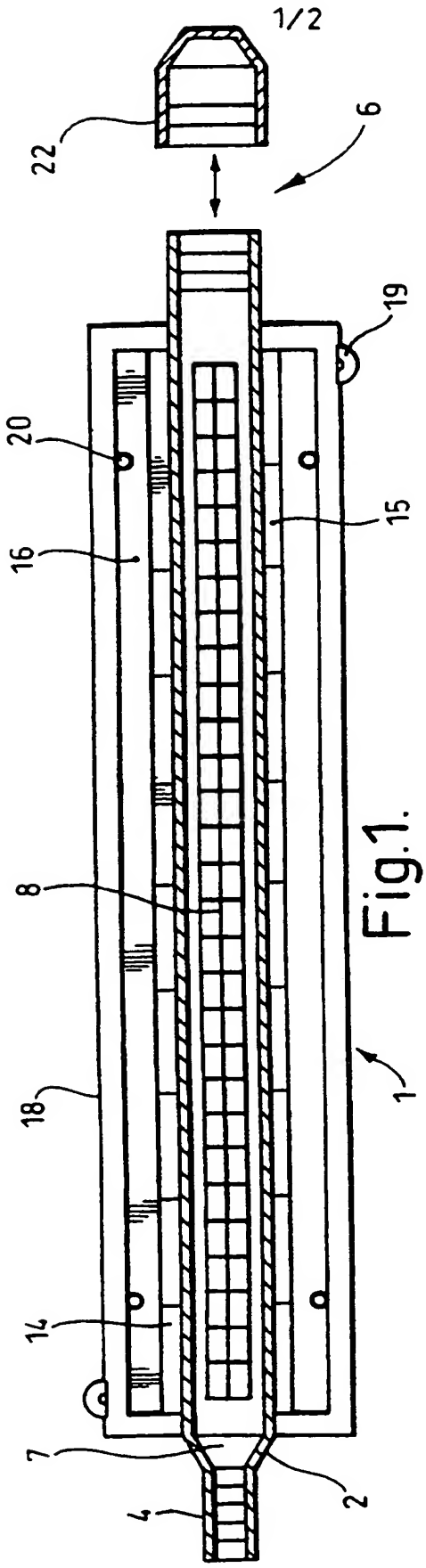

Fig.1.

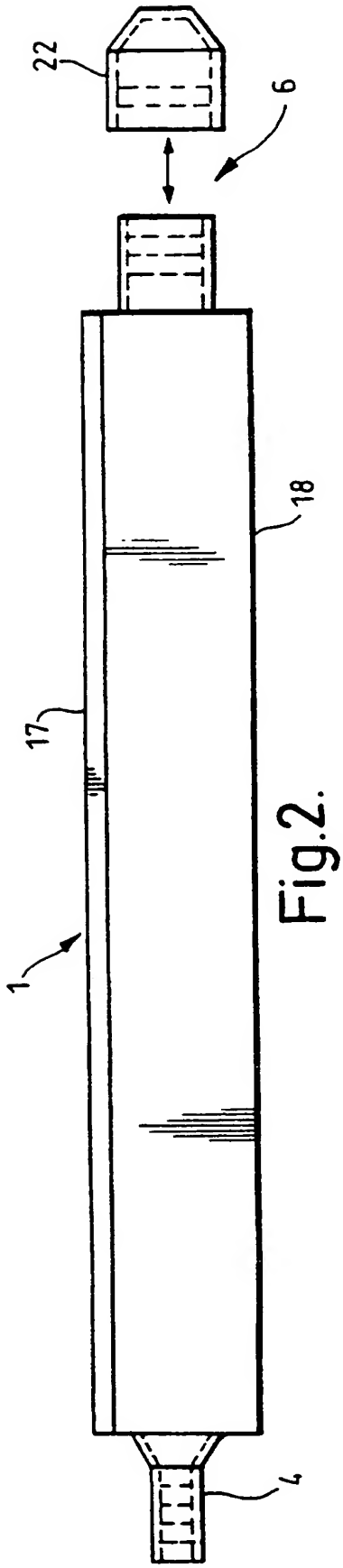

Fig.2.

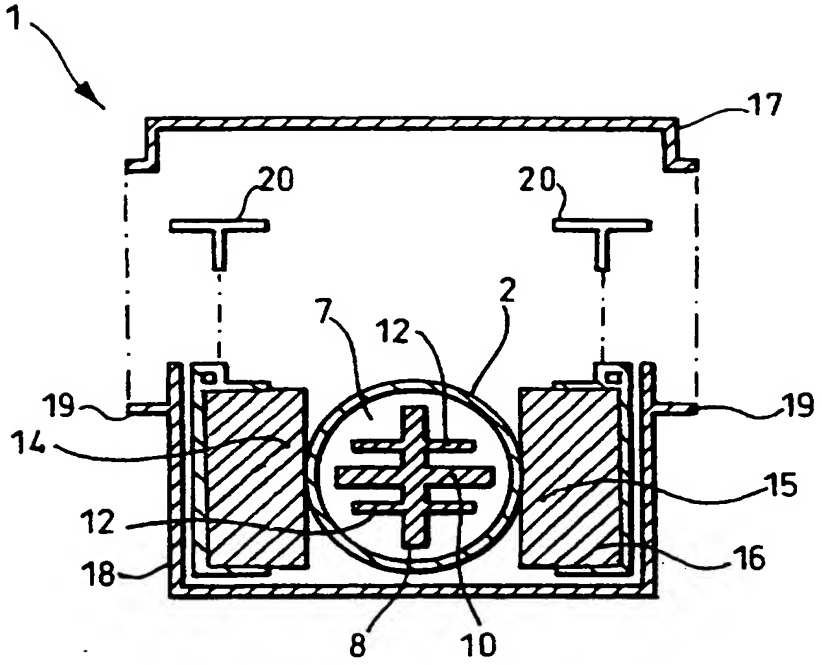

Fig.3.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 97/01930

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 F02M27/02 F02M27/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 F02M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 2 247 919 A (FUEL DYNAMICS) 18 March 1992 cited in the application see page 5, line 25 - page 7, line 11; figures 1-3 see page 7, line 13 - page 8, line 29; figures 4-7	1-4, 6-13, 16-18, 30,31
A	US 5 307 779 A (WOOD ET AL.) 3 May 1994 see abstract see column 3, line 9 - column 5, line 5; figures 1-4	1-4,6, 8-12,30, 31

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
10 November 1997	17/11/1997

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INTERNATIONAL SEARCH REPORT

International Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 43 29 329 A (KROPP ET AL.) 2 March 1995 see column 2, line 15 - line 23; figures 1,2	15,19,20
A	US 5 129 382 A (STAMPS ET AL.) 14 July 1992 see column 4, line 3 - line 15; figures 1,2	22,23
A	PATENT ABSTRACTS OF JAPAN vol. 95, no. 8 (M-00), 29 September 1995 & JP 07 119564 A (SHIGEJI NAGUMO), 9 May 1995, see abstract	

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/GB 97/01930

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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US 5307779 A	03-05-94	CA 2113507 A	15-07-94
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US 5129382 A	14-07-92	AU 6858091 A	19-03-92